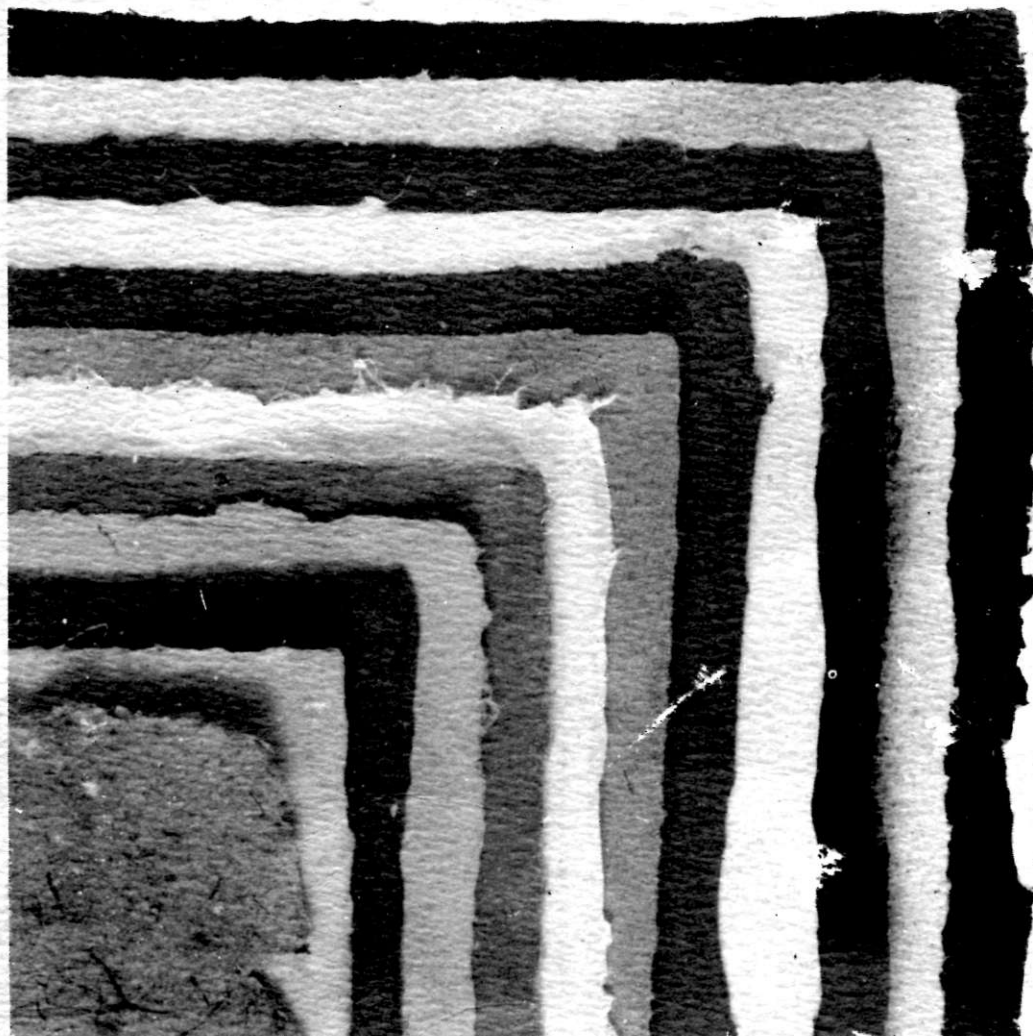


PAPERMAKING

second edition

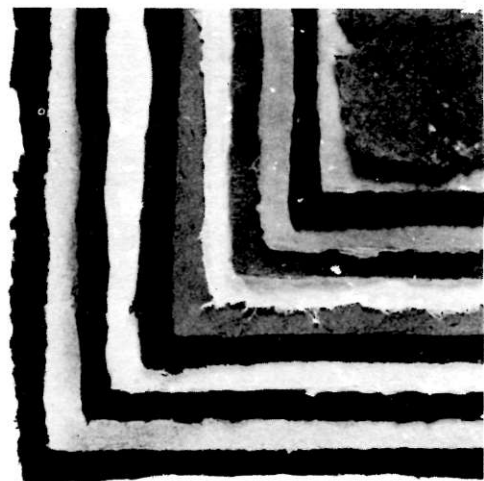
HOW TO START YOUR OWN



Introduction

Hand papermaking is an interesting craft. Today, with the presence of tons of waste paper that could be recycled, plus the simplifications introduced in the pulping method and the basic tools, we can now enjoy an inexpensive handicraft right in our own homes.

The results are immediate and the basic process offers unlimited challenge and creativity. Here is a simple step-by-step approach.





Basic Materials and Equipment

1. Mould & deckle — made of bamboo screen and wood
2. Basin — big enough for the mould and deckle to fit in
3. Rolling pin
4. Mortar and pestle
5. Blotting papers or flannel cloth
6. Drying boards
7. Used papers
8. Mixer or blender
9. Pail — 30 liters cap.
10. Cooked starch
11. Rosin
12. Alum
13. Mucilage

Materials and Equipment for Making of Paper Pulp

1. Agricultural fibers or grasses
2. Caustic soda
3. Stainless steel or enamel-lined kettle
4. Weighing scale
5. Measuring cup
6. Stove
7. Knife
8. 150 — mesh metal screen
9. Chopping board
10. Ladle

Hand Papermaking from Waste Paper

1

Cut the used paper (typewriting, onion skin, pad, etc.) into pieces of around one-half inch square. Soak in water for at least one day to allow the water to penetrate thoroughly, thus softening the paper.

2

Beat or pound the soaked paper with mortar and pestle, then disintegrate it with a cake mixer or by hand until the paper becomes separate frayed fibers. Test by dropping a small amount of beaten paper into a glass of water. If fibers disintegrate easily leaving no lumps after blending with water, then beating is already sufficient.

3

Prepare pulp slurry by distributing the beaten pulp into a basin of water until desired consistency is attained. If thin paper is desired, then more water is added. For thicker paper, less water is necessary. For paper with thickness more or less similar to bond paper, 3 grams of pulp for every liter of water is advisable.

4

To the pulp slurry add cooked starch to serve as a binder. Amount of starch needed is usually 10% based on the dried weight of pulp. This means that if you have 1 kilo of dried used paper pulp you will need 100 grams of starch (refer to the "glossary of terms" for the cooking of starch).





5

Add 2% rosin based on dry weight of pulp. Then add 4% alum. Preparation of 2% rosin is as follows: If you have a kilo of dry pulp, weigh 20 grams rosin, and dissolve this in 1 liter of lukewarm water. For alum you need 40 grams for every 1 kilo of dried pulp. Dissolve the alum in 1 liter of hot water.

6

Stir the pulp slurry. Add one cup thick mucilage. This substance is added to the slurry in order to retard the flow of water through the screen thus providing time for vibrating the pulp.

7

Fit the mould and deckle. Stir the slurry by hand to be sure that pulp is well distributed and mixed.

8

Dip the mould and deckle into a basin of slurry, positioning the deckle toward the paper maker side and allowing the slurry to flow slowly toward the other side throwing excessive slurry back to the basin. Slowly tilt the mould and deckle back to the maker side and then tilt again towards the opposite side. This process is repeated until most of the water has drained through the bamboo screen.

9

Separate the mould from the deckle. Take out the mould and lay it on pieces of blotting paper. Cover the formed sheet with blotting paper and turn it upside down. Wipe off the water left on the bamboo screen with a piece of flannel cloth. Separate slowly the mould from the sheet.

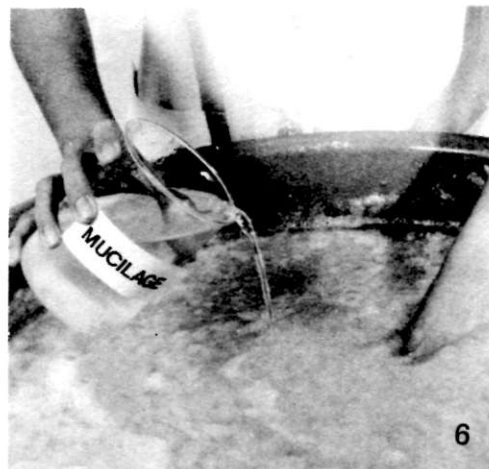
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Cover the sheet with 2 or more pieces of blotting paper and use a rolling pin on top, to squeeze out water.

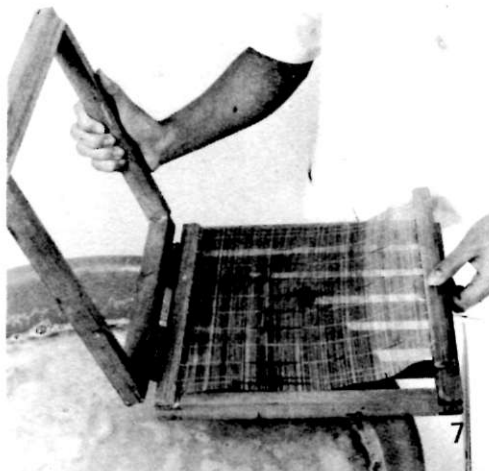
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Separate the sheet from the blotting paper and set it aside on top of the wooden board padded with blotting paper or flannel cloth.

Repeat Steps 7 to 11



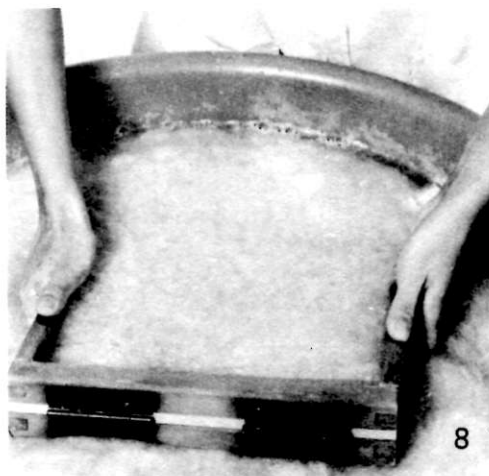
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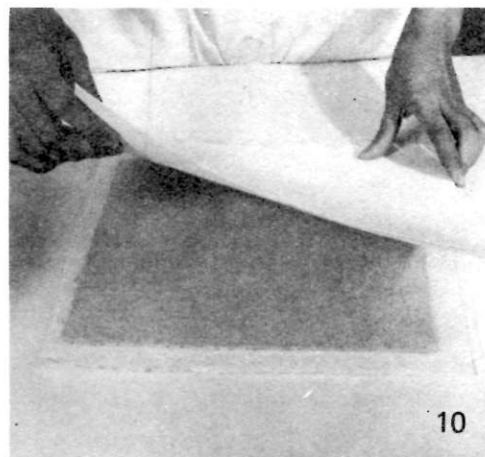
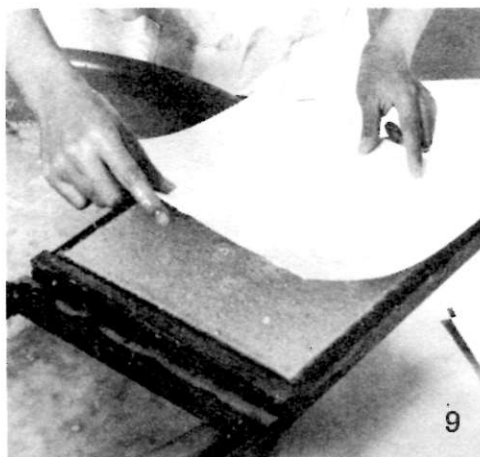
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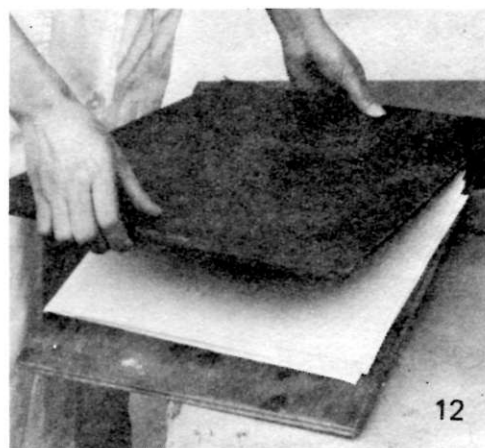
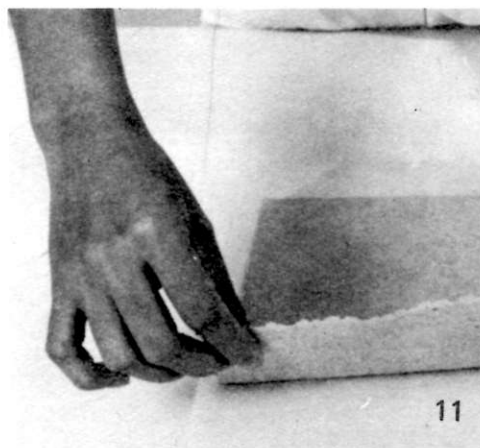
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As soon as you have a pile of wet paper, press them en masse. A press may be a screw press, a letter copying press, vulcanizing press or simply 2 wooden boards whose surface area is bigger then the formed sheets. It can be done by placing one smooth-surfaced board on the floor with the wet formed sheets on top of it and the other board on top of the wet pile, with heavy objects laid on top to squeeze out the remaining water.



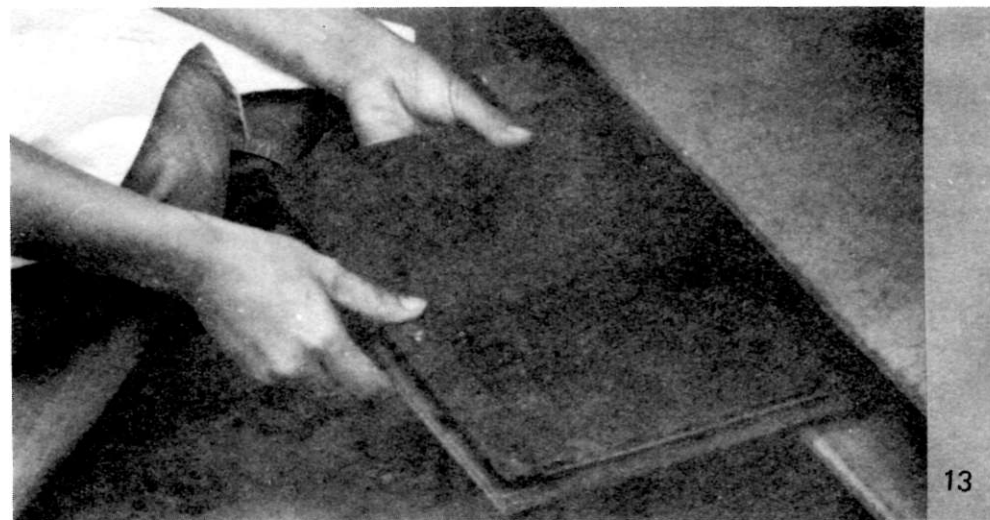
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Take out the papers from the press. Separate each piece, (from a pad of finished papers) and dry it on top of a wooden drying board in open air. It can also be dried by hanging the paper over a pole or line in an open air.



14

If smooth paper is desired, the dried sheets may be pressed again. Hand Paper making can also be carried out by making your own pulp out of agricultural fibers or grasses.



The making of Paper Pulp: Soda Process

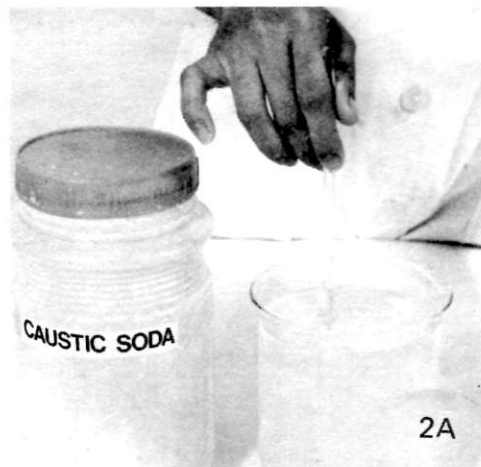
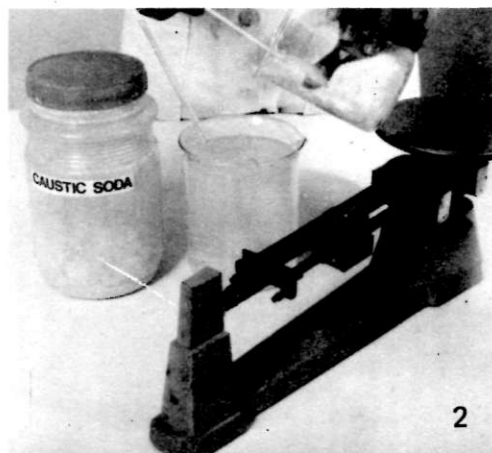
1
Cut the fibers with knife or a pair of scissors into lengths of about one inch. Weigh 1 kilo and place them inside the stainless steel or enamel lined kettle.



2
Prepare 18% caustic soda solution by dissolving caustic soda flakes in water. Preparation of the 18% caustic soda solution is as follows: If you are pulping a kilo of fibers, weigh 180 grams of caustic soda flakes and then dissolve this in 1 liter of water.

3
Add the caustic soda solution into a kettle containing the fibers.

4
Measure 19 liters of water and add this into the same kettle.



5

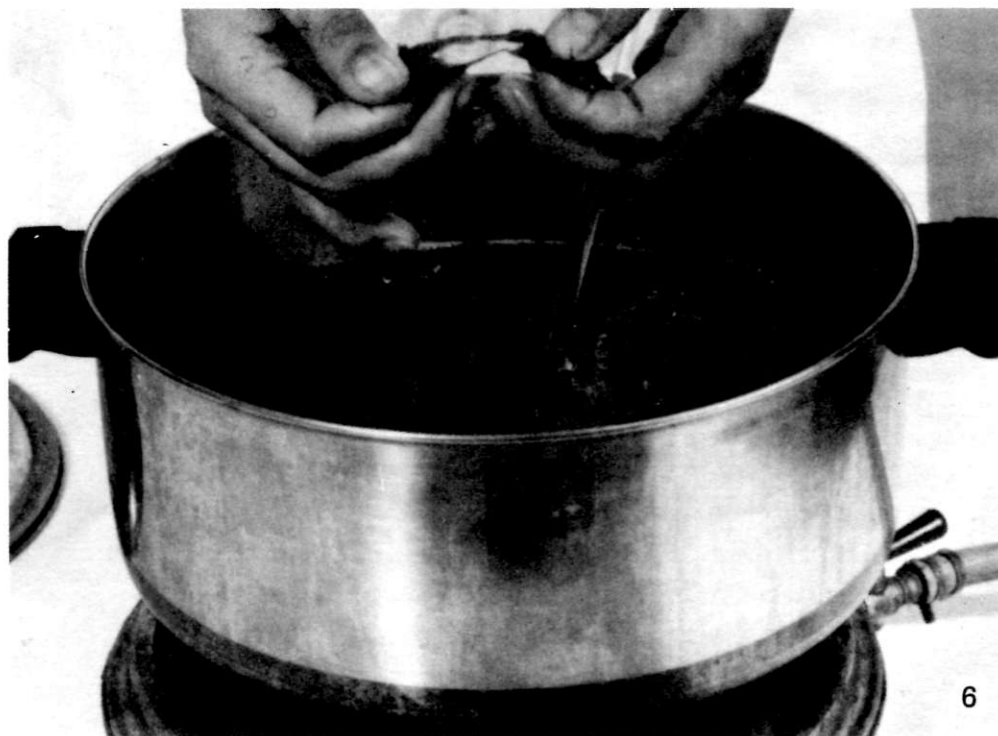
Boil the above preparation for about 3 to 4 hours in order to dissolve and remove non-cellulose matter and separate cellulose fibers.



5

6

Test by getting a small amount of cooked fibers and squeeze them with the fingers. If fibers break off easily with only slight pressure applied, then cooking is enough. Grasses like tikog, talahib or rice straw take only from 30 minutes — 1 hour boiling.



6

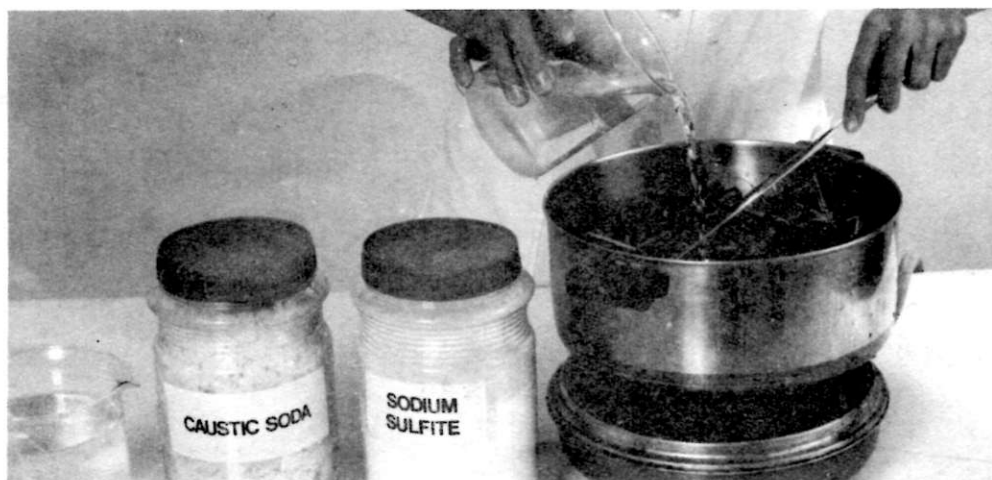
Sulfite Process

Aside from the soda process we have the sulfite and the sulfate processes of pulping. These types of pulping produce stronger and whiter pulp than the pulping process using the 18% caustic soda otherwise known as the soda process.

The sulfite process uses 8% sodium sulfite solution with the 16% caustic soda as the cooking chemicals. Preparation of this solution is as follows:

Based on 1 kilo (1 kilo = 1,000 grams) of fibers to be pulped:

- (a) Weigh 80 grams of sodium sulfite and dissolve this in 1 liter of water.
- (b) Weigh 160 grams caustic soda flakes and dissolve this in 1 liter of water.
- (c) Add the solutions prepared in (a) & (b) into a kettle containing 1 kilo of dried fibers.
- (d) Measure 18 liters of water and add this into a kettle containing the fibers, sodium sulfite and caustic soda solution.
- (e) Follow steps 5 & 6 on "The Making of Paper Pulp".



Sulfate Process

In the sulfate process the cooking chemicals are 8% sodium sulfide with 16% caustic soda solution. Procedure in preparing the solution are as follows:

Based on 1 kilo (1 kilo = 1,000 grams) of dried fibers to be pulped.

- (a) Weigh 80 grams of sodium sulfide and dissolve this in 1 liter of water.
- (b) Weigh 160 grams caustic soda flakes and dissolve this in 1 liter of water.
- (c) Add the solutions prepared in (a) & (b) into a kettle containing 1 kilo of dried fibers.
- (d) Measure 18 liters of water and add this into a kettle containing the fibers, sodium sulfide and caustic soda solution.
- (e) Follow steps 5 & 6 on "The Making of Paper Pulp".

7

The cooked pulp is sieved in a 150-mesh wire screen at the same time washing the cooked pulp with running water, in order to drain off used cooking chemicals together with other impurities.

8

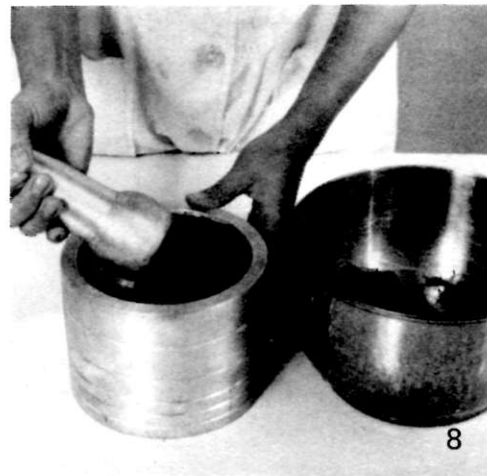
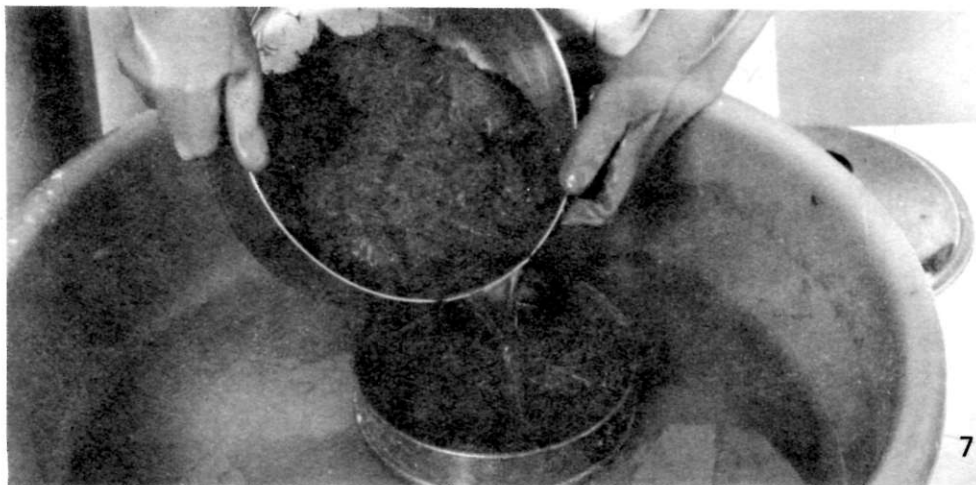
The washed pulp is beaten with mortar and pestle to flatten the fibers. This is to increase the surface area of the fiber so that there will be a good fiber-to-fiber bonding during the paper formation. Beating also allows the pulp to swell and gelatinize, properties necessary in papermaking.

9

Dry and weigh the beaten pulp.

10

Papermaking process is carried out following steps 3 to 13 on "Hand Papermaking From Waste Papers."



Bleaching the Pulp

If it is desired to whiten the pulp, the following steps are to be undertaken before the papermaking process.

1
Dry and weigh around 1 kilo of prepared pulp and put it in a kettle.

2
Prepare calcium hypochlorite solution (10% based on dry weigh of pulp) of dissolving 100 grams of calcium hypochlorite powder in 1 liter of water.

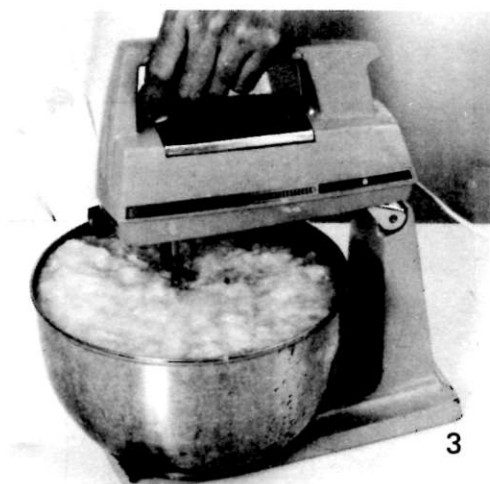
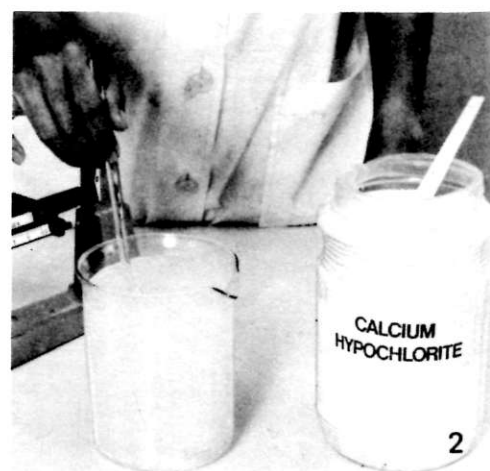
3
Prepare pulp slurry by dissolving 1 kilo of pulp in 10 liters of water.

4
Allow the slurry to boil for around 3 minutes. Add the prepared calcium hypochlorite solution.

5
Add 7 liters of water making the total volume of bleaching solution 18 liters. With constant stirring bring the solution to boil and continue boiling for 20 minutes.



1



3

6

Transfer the pulp into a 150-mesh metal screen and wash the pulp with running water.

7

Prepare 1% lumiphor solution by dissolving 10 grams of lumiphor in 15 liters of water.

8

Soak the pulp for 30 to 50 minutes in the lumiphor solution.

9

Transfer the pulp in a 150-mesh metal screen and wash the pulp with running water.

10

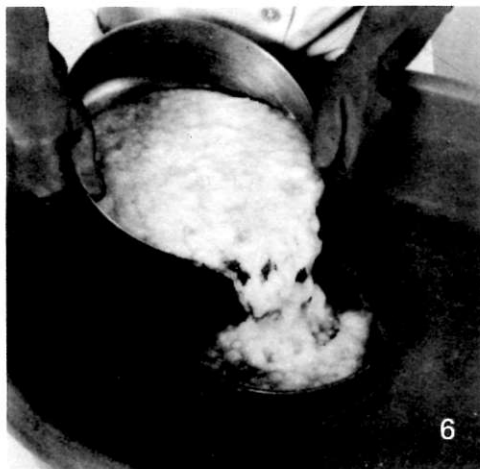
Dry the pulp and weigh.



8



4



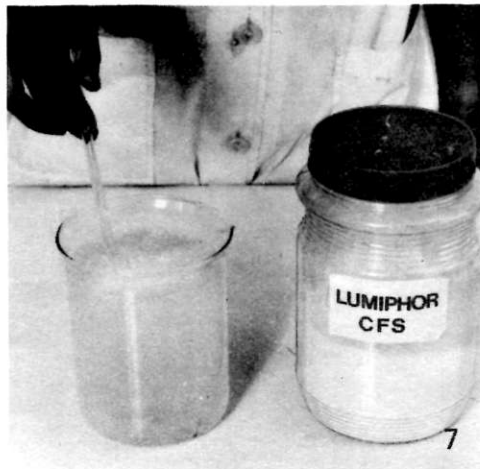
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9



5



7



10

Dyeing the Pulp

If it is desired to produce colored paper, the following steps are to be done after the bleaching procedure.

1

(Based on 1 kilo of dried pulp)

Prepare 15 grams basic or direct dye. Dissolve this by making paste with small amount of lukewarm water. Add this into a kettle. Add 20 liters of water and raise the temperature to 40°C.

2

Wet the weighed pulp in a small amount of water. Add the pulp into the dyebath and raise the temperature to boiling, stirring often for 10 minutes. Add 200 grams salt. Continue boiling with constant stirring for 20 minutes.

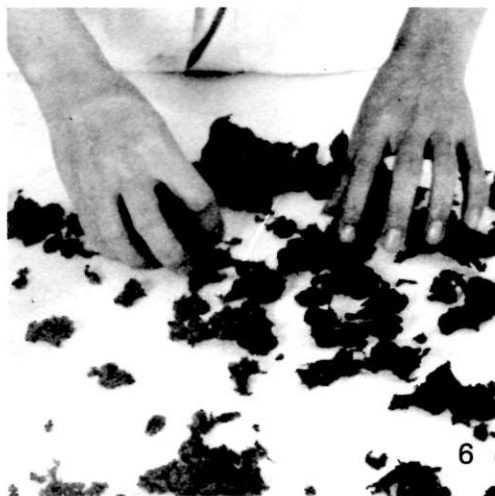


3
Rinse pulp with water in 150-mesh screen.

4
Treat with trifofix by adding 40 grams trifofix into a kettle containing the washed dyed pulp in 10 liters of water. Raise the temperature to 60°C and maintain for 15 minutes.

5
Transfer the dyed pulp into a 150 mesh screen and wash with running water.

6
Weigh and dry the pulp. Proceed to the papermaking process by following steps 3 to 14 on "Hand Papermaking from Waste Papers."



Glossary of Terms

Alum — a chemical compound added to the pulp slurry containing rosin, for effective rosin sizing.

Beating — the operation involved in the reduction and flattening of fibers into the fines required for papermaking.

Binder — substance added to the slurry to make paper firmer and to prevent the projection of fibers from the surface of the sheet. Starch is commonly used.

Blotting Papers — soft spongy paper that absorbs water when it comes in contact with any wet object. This is available in any office or school supplies outlets.

Caustic soda solution — a mixture of sodium hydroxide with water.

Cellulose — Fibers obtained by treating vegetable matter with caustic soda solution.

Cooking chemical or solution — chemical like caustic soda mixed with water and is used in cooking the fibers.

Deckle — wooden frame that confines the pulp in the frame.

Drying Board — A flat surface where formed sheets of paper are allowed to dry.

Dyebath — Kettle containing the dye in water.

Fiber — a natural substance that contains chiefly cellulose, has a length many hundred times greater than its width, possesses considerable tensile strength, pliability and resistance against heat, light and some chemicals at a certain temperature and pressure.

Gelatinize — property of the slurry to have jellylike consistency.

Mould — the sieve or screen that strains the pulp and on which the sheet is formed.

Mucilage — That slimy substance of okra extracted by soaking then blending the sliced okra fruit with water and straining the solution. The solution is mixed with the pulp slurry. A kilo of pulp may need around 10 pieces of regular-sized okra fruit as the source of mucilage.

Rosin — substance used to size paper. This is prepared by cooking resin in caustic soda solution in a water bath (6 parts resin, 1 part sodium hydroxide, 12 parts water).

Sizing — Chemical, often rosin or cooked starch, added to the mixture of pulp and water or applied on the paper surface to increase the resistance of the dried sheet to penetration of liquid particularly water and ink.



Rosin



Caustic Soda Solution



Fiber

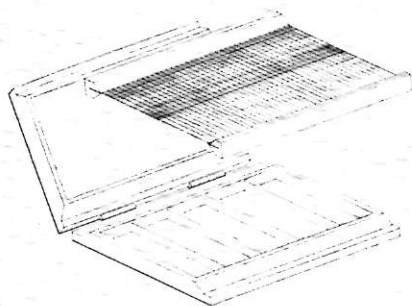


Dyebath

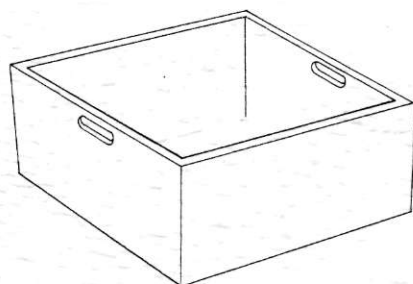
Slurry — pulp in water before lifted on the screen

Starch — preparation is done by cooking 100 grams of cassava or corn starch in 3 cups of water for about 5 minutes.

150-mesh metal screen — device made of stainless, steel, that has 150 opening per linear inch, used to allow only liquid or smaller particles to pass through and can be mounted on a frame.



Mould and Deckle



150-mesh metal screen

Information on Supplies

Supplies may be purchased from various distributors. However, you can check the yellow pages of your telephone directory or write to the following:

Caustic Soda, sodium sulfite —
Harwell Chemicals Corporation
Ponte Street, Makati, Metro-Manila

Dyes, trifofix —
Chem Dyes, Philippines
Caustic Soda & Chemicals
151 Pinatubo Street
Mandaluyong, Metro-Manila

Blotting papers
Sanggumay Marketing
C.M. Recto, Manila

Okra available in Public Market

Starch available in Public
Markets or Supermarkets

Resin
Hardware Stores

Rosin
Philippine Pigment
& Resin Corp.
Malibay, Pasay City

